

of this torrent of negatively charged molecules which are projected from the negative carbon. If we employ a soft iron rod as our lateral pole, we find that, after enduring for some time the projection of the arc against it, it is converted at the extremity into *steel*.

Into the fuller discussion as to the molecular actions going on in the arc, the source and nature of that which has been called the counter-electromotive force of the arc, and the causes contributing to produce unsteadiness and hissing in the arc, I fear that I shall not be able to enter, but will content myself with the exhibition of one last experiment, which will show you that a high vacuum, or, indeed, any vacuum, is not necessary for the production of the "Edison effect." Here is a carbon horseshoe-shaped conductor, not inclosed in any receiver (see Fig. 17). Close to the negative leg or branch, yet not touching it, we have adjusted a little metal plate. The sensitive galvanometer is connected between this metal plate and the base of the other or positive leg of this carbon arch.

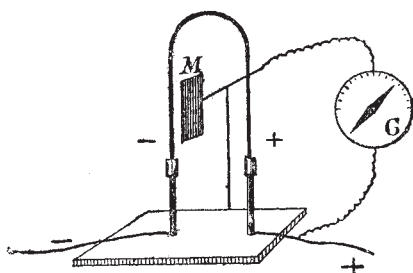


FIG. 17.—"Edison effect" experiment shown with carbon in open air.

On sending a current through the carbon sufficient to bring it to bright incandescence, the galvanometer gives indications of a current flowing through it, and as long as the carbon endures, which is not, however, for many seconds, there is a current of electricity through it equivalent to a flow of negative electricity from the plate through the galvanometer to the positive electrode of the carbon. The interposition of a thin sheet of mica between the metal plate and the negative leg of the carbon loop entirely destroys the galvanometer current.¹

These experiments and brief expositions cover a very small portion of the ground which is properly included within the limits of my subject. Such fragments of it as we have been able to explore to-night will have made it clear that it is a region abounding in interesting facts and problems in molecular physics. The glow-lamp and the electric arc have revolutionized our methods of artificial lighting, but they present themselves also as subjects of scientific study, by no means yet exhausted of all that they have to teach.

NOTES.

PROF. E. RAY LANKESTER, F.R.S., has been elected Deputy Linacre Professor of Human and Comparative Anatomy, Oxford.

TO-DAY a meeting will be held at the Mansion House in support of the International Congress of Hygiene and Demography, which is to be held in London in 1891. The Prince of Wales has consented to act as President of the forthcoming Congress; and it is expected that the meetings will be "of great magnitude and importance." Many delegates have already been appointed, and other nominations are being received daily. It is necessary, therefore, that a definite organization should be formed, and that a fund should be raised for the defraying of expenses.

¹ This last experiment is due to my assistant, Mr. A. H. Bate.

ON Wednesday next, July 9, Prof. T. McKenny Hughes F.R.S., will deliver a lecture in the saloon of the Mansion House on the question, "Is there coal in the south-east of England?" The Lord Mayor will preside, and will be supported by the "Coal Search Committee." This Committee has been formed for the purpose of taking steps to discover whether there really are good coal-fields in the south-east of England, and, if so, to what extent. It consists of scientific and commercial men, and their services are gratuitous. Among the members are Prof. Boyd Dawkins, Colonel Godwin-Austen, Prof. A. H. Green, Dr. Henry Hicks, Mr. W. H. Hudleston, Prof. Edward Hull, Dr. A. Irving, Prof. J. W. Judd, Sir John Lubbock, Prof. Meldola, Mr. F. W. Rudler, Prof. W. J. Sollas, Mr. J. J. H. Teall, Mr. W. Topley, Mr. W. Whitaker, and Dr. H. Woodward.

A NEW scientific Society (Die Deutsche zoologische Gesellschaft, on the lines of the Anatomische Gesellschaft) has just been founded. Early in May, nine representatives of zoology in German Universities issued a circular inviting brother zoologists to unite in forming a Zoological Society. On May 28 a preliminary meeting was held at Frankfurt, and zoologists from nearly a dozen German Universities were present. At present there are fifty-four members, and the next meeting is to be held on August 1, when a President will be chosen. The invitations to this meeting will be issued early in July. Applications for membership may be sent to Prof. Bütschli (Heidelberg), Prof. Victor Carus (Leipzig), or Prof. Spengel (Giessen). The foundation of this Society is a step in the right direction, and it is to be hoped that the new Zoologische Gesellschaft will speedily become as cosmopolitan as the sister anatomical one.

THE Norwegian Storthing, by 73 votes against 39, has voted a grant of 200,000 kroner for Dr. Nansen's North Pole Expedition.

THE third summer meeting of University Extension and other students will be held at Oxford in August next. The meeting will be divided into two parts. The first part of the meeting will begin with an inaugural address by Prof. Max Müller at 8.30 p.m. on Friday, August 1, and will end on Tuesday evening, August 12. The second part of the meeting will begin on Wednesday morning, August 13, and end on Tuesday evening, September 2. This period will be devoted to quiet study. The courses of lectures will be longer than those delivered during the first part of the meeting, and will deal in greater detail with the subjects then introduced.

SIR HENRY W. ACLAND has published a letter on "Oxford and Modern Medicine." It is addressed to Dr. James Andrew, and was printed originally for private circulation. In the preface the author expresses an earnest hope that "the broad and yet precise study of material science and of nature may prosper at Oxford, as part of the whole range of University thought, and that in the haste for technical education our physicians may not be relegated as some now desire into a professional class or clique by themselves, but be as formerly a living part of the whole of the scientific and literary University."

THE third International Shorthand Congress will be held at Munich from August 7 to 17. The centenary of F. X. Gabelsberger, the originator of modern German shorthand, will be celebrated by those who attend the meetings, and a bronze statue of him will be unveiled.

ACCOUNTS which have reached the *Times* from the Weatherby district, in Yorkshire, agree as to the occurrence of distinct earthquake shocks on Wednesday, June 25, about 10.30 p.m., and again on Thursday morning about four o'clock. Mr. John Emmet, of Boston Spa, sixteen miles from Leeds, states that shocks were experienced, not only at Boston Spa, but at Wighill, Clifford, Thorp Arch, Weatherby, and other places, and he

adds, "Crockery was heard to shake, and some of it was broken. Those who had retired to bed felt their houses and beds shaking, and rushed into the street. . . Those who were abroad in the street had to lay hold of something to keep them from falling."

MESSRS. MACMILLAN AND CO. have nearly ready for publication two works of great interest to students of ornithology, both of American origin. The first is a treatise on the "Myology of the Raven," intended as an introduction to the study of the muscular system in birds, by Dr. R. W. Shufeldt, of the Smithsonian Institution. The second is a revised re-issue, in one volume of convenient size, of the very valuable monographs on field ornithology and on general ornithology which were prefixed to Dr. Elliott Coues's monumental "Key to North American Birds." Part I., on field ornithology, contains the necessary instructions for the observation and collection of birds in the field, and for the preparation and preservation of specimens for scientific study. Part II. is a technical treatise on the classification, the zoological characters, and the anatomical structure of the class of Birds, in which the examples cited in illustration of the principles of ornithology have for the most part been re-drawn by the author from British instead of American birds.

MESSRS. D. MARPLES AND CO., Liverpool, have issued the presidential address delivered by the Rev. Henry H. Higgins at the meeting of the Museums Association, lately held at Liverpool. In the course of the address he gives an interesting account of the principal kinds of fittings and apparatus used in the Liverpool Museum.

MESSRS. MAWSON, SWAN, AND MORGAN propose to issue a lithographed facsimile of an old manuscript volume of apothecaries' lore and household recipes, which was discovered some years ago amongst the papers belonging to the old firm of Gilpin and Company, chemists, Pilgrim Street, Newcastle. Careful examination, in which some of the curators of the British Museum have assisted, shows that the manuscript dates from about the time of Queen Elizabeth, additions having been made from time to time, in various handwritings, up to the middle of last century.

UNDER the auspices of the Royal Dublin Society, and partially aided by the Government, a scientific investigation of Irish fishing grounds is now being carried on upon the south-west and west coasts of Ireland. The Rev. W. Spotswood Green, Her Majesty's Inspector of Fisheries, Dublin, and Prof. A. C. Haddon, of Dublin, organized the expedition, which is expected to last four or five months. The screw steamer *Fingal*, of Glasgow, 160 tons register, chartered for the cruise, left Queens-town on May 7, having on board Mr. Green, Prof. Prince, Mr. T. H. Poole, of Cork, special surveyor to the expedition, and a crew of seamen experienced in trawl, net, and line fishing. Prof. Prince, who has conducted elaborate investigations upon the embryology of food-fishes at St. Andrews, and later on, Mr. E. W. L. Holt, also of St. Andrews Marine Laboratory, superintended the zoological department until Prof. Haddon was able to join the steamer. Dr. R. Scharff, of the Science and Art Museum, Dublin, and other gentlemen have temporarily assisted on board. The *Fingal* has been specially fitted up for the work. Several beam trawls (including patent forms), a quantity of mackerel nets, thirteen miles of long lines, large tow-nets (after Prof. McIntosh's pattern), microscopes and instruments for zoological and physical research, are included among the appliances. The coast from Cape Clear to Killybegs Bay (Donegal) has already been traversed, and about thirty stations have been tested and results of value obtained. In the open sea and in inshore waters the eggs and larval stages of mackerel, ling, gurnard, haddock, turbot, witch, and other species of food-fishes have been obtained, and a great variety of invertebrates, including some rare echinoderms, annelids, molluscs, &c., have been

brought up in the dredge and trawl, the greatest depth tested up to this time being about 100 fathoms. The estuary of the Kenmare river, Dingle Bay, Smerwick, Birtterburg, and Roundstone Bays, and the harbour of Clifden, proved to be very rich in invertebrate forms, specimens of *Synapta inkarens*, being abundant, while *Bonellia*, *Priapulid*, and many rare molluscs, *Lyonsia*, *Philine*, and various nudibranchs were procured. Copepods, larval crustaceans, medusæ, echinoderms, and ascidians occurred in such quantities as to frequently cause great inconvenience. A fine example of *Orthogoriscus mola*, nearly 9 feet in dorso-ventral measurement, was shot by Mr. Green and secured, and the rare Pleuronectid, *Arnoglossus gröhmanii*, was obtained in Clifden Harbour, the second specimen captured in British seas. Deep-sea dredgings will be taken, and it is expected that the reports, to be presented at the end of the cruise to the Royal Dublin Society, to the Irish Fishery Department, and the Government, will be of unusual scientific interest.

SOME valuable notes on the progress of the coloured people of Maryland since the American civil war have been printed in the series of "Johns Hopkins University Studies in Historical and Political Science." The author is Dr. J. R. Brackett. He takes a more favourable view of the subject than is adopted by many American observers, and deprecates the idea of good citizens allowing "the coloured people to be condemned before the testimony is all in, at a fair, unbiassed trial." There are now a good many schools for coloured children, and conventions of coloured teachers are held. The most discouraging fact in connection with the progress that has been made is that everything has been gained by the energy of a few leaders. The coloured people, according to one of themselves, are "too spasmodic"; they are "too prone to grow tired in well doing."

THE Town Gardening Committee of the Manchester Field Naturalists' Society, to which we lately alluded, has been vigorously prosecuting its work. The esplanade in front of the Manchester Infirmary and Albert Square, in which the Town Hall stands, are now decorated with seventy-five beautiful specimens of holly and aucuba, whose bright green leaves show up with good effect against the darkened stone of the neighbouring buildings. The plants have been placed in substantial but movable boxes 3 feet square and 4½ feet in height. The Parks Committee of the Manchester Corporation, of which Mr. Chesters-Thompson is chairman, has shown a laudable anxiety to carry out the plans suggested, and has contributed the greater part of the £500 already spent by the two committees on plants. It is hoped next year to carry on tree-planting on a large scale in the open spaces and streets of Manchester, and with a view to ensuring success under the extremely unfavourable atmospheric conditions peculiar to the city, the Town Gardening Committee is occupied in collecting all information relating to the subject, and will shortly issue a pamphlet of recommendations to those actually engaged in the work. Dr. Bailey, of Owens College, will contribute an essay on the effect of noxious gases on plants, and Dr. Poisson, of the Museum in Paris, will send a detailed account of the progress and experience gained in tree-planting in French towns. Several of our most distinguished botanists have also consented to act as corresponding members of the committee. It is probable that the movement will spread rapidly over the north of England, as the committee has already received official and unofficial requests for information about the work from Liverpool, Carlisle, Leek, and many other towns. The honorary secretary, Mr. C. J. Oglesby (16 Kennedy Street, Albert Square, Manchester), will be glad to receive additional information from anyone who may have had experience in the cultivation of trees and plants in manufacturing towns.

AMONG the papers read at the closing meeting of the Royal Society, was one by Prof. Ewing, of the Dundee College, entitled, "Contributions to the Molecular Theory of Induced Magnetism," in which experiments of a novel and curious kind were described, leading to an important conclusion. Prof. Ewing has examined experimentally Weber's theory of molecular magnets, according to which the molecules of iron are always magnets, which point anyhow in an unmagnetized piece, but are turned round to point one way when the iron is magnetized. It is well known that in the development of this theory by Maxwell and others there has been much difficulty in reconciling the results of the theory with what is known about the magnetic quality of iron and steel, and many arbitrary assumptions have been suggested in order to make the theory fit the facts. Prof. Ewing's experiments have removed this difficulty, showing that no arbitrary assumptions are necessary, and that the known character of the magnetizing process may be deduced from the molecular theory in its simplest form. The experiments were made by means of a model in which a large number of small pivoted permanent magnets are grouped to represent the molecular structure of iron. When a magnetic field is applied, the action of the small magnets on one another makes them behave in a way that exactly agrees with the observed behaviour of a bar of solid iron when it is magnetized. The model exhibits all the variations of susceptibility which are known to take place, and explains how magnetic hysteresis occurs without anything like friction among the molecules.

ACCORDING to the *Ceylon Observer*, Mr. A. T. W. Marambe, of Kandy, the translator of "Gulliver's Travels" and the author of "A Practical Synopsis of Ceylon History," has in preparation a little work on the Veddah language. Many have attempted this task before, but without success. Besides Veddah songs, a description of habits and customs, &c., the book will have a completer list of words than has hitherto appeared.

AN exceptionally pretty and instructive series of new experiments, upon the action of carbon heated to whiteness in the electric arc on various gaseous compounds, are described in the current number of the *Berichte* by Prof. Lepsius, of Frankfurt. Perhaps the most important are a group of four experiments illustrating the relative combining powers of the four elements iodine, sulphur, phosphorus, and carbon. The apparatus employed consists of a specially modified Hofmann eudiometer, one limb of which is 40 mm. in diameter and 300 mm. long, and the other longer limb narrower and furnished with a mercury reservoir at its upper end. The wider limb, which is the reaction-tube, is furnished with a stop-cock at the top, and just below this are two tubuli through which the adjustable carbon poles are inserted. At the base of the wider limb a second stop-cock is placed so as to permit of the adjustment of the mercury. The gas to be experimented upon is introduced into the apparatus at the upper stop-cock by allowing mercury to run out at the base. Four such eudiometers are arranged in a row, and 100 c.c. of gas introduced into each. Into the first, hydriodic acid is introduced; into the second, sulphuretted hydrogen; into the third, phosphuretted hydrogen; and into the fourth, marsh-gas. The gases thus stand at the same level in each of the four reaction-tubes. The current from a battery whose electromotive force should amount to 60-80 volts is then allowed to pass between the carbon poles, which are, of course, in contact at first, and then gradually drawn away until the maximum arc is obtained. Each reaction may be performed separately, or all four may be allowed to proceed simultaneously by adopting an arrangement in multiple arc. In hydriodic acid the brilliant arc light is tinted a magnificent purple and the whole space above the mercury becomes filled with violet vapour of iodine. Notwithstanding the considerable heating effect of the discharge, the volume of gas perceptibly diminishes, the liberated iodine

rapidly depositing in minute crystals upon the walls of the tube. So rapid, indeed, is the diminution in volume, that mercury requires to be poured into the reservoir to prevent the entrance of air into the reaction-tube. In a very few minutes the reaction is complete, and the mercury ceases to rise. In sulphuretted hydrogen the light is coloured blue, and copious clouds of sulphur are produced, which settle upon the walls in the form of a white transparent coating. The volume of gas is considerably augmented, owing to the expansion by heat, and the reaction is likewise completed in a very brief space of time. In phosphuretted hydrogen the arc glows with a dazzling red light; the volume visibly augments at a rapid rate, and red clouds of phosphorus are thrown off, the glass walls being covered with red phosphorus, among which are to be found notable quantities of the ordinary yellow variety. The mercury attains its maximum height in the narrow limb in a minute at most from the moment of switching on the current. In the case of marsh-gas, the whiteness of the arc appears at first to be rendered more intense, and is surrounded by dense black clouds of carbon, which form a striking background. The upper part of the vessel, however, soon becomes covered with an opaque deposit, which perceptibly diminishes the brilliancy of the light. The volume appears to increase by leaps and bounds, and in a few seconds attains its maximum. At the end of the experiment, after cooling, the volume of hydrogen left in the first case is 50 c.c., in the second 100 c.c., in the third 150 c.c., and in the fourth case 200 c.c., thus showing in a most striking manner that an atom of iodine combines with one atom of hydrogen, sulphur with two, phosphorus with three, and carbon with four atoms of hydrogen.

THE additions to the Zoological Society's Gardens during the past week include a Bosman's Potto (*Perodicticus potto*) from West Africa, presented by Mr. P. S. S. Radcliffe; a Harnessed Antelope (*Tragelaphus scriptus* ♂), a — Antelope (*Cervicapra* sp. in. ♂), two Marabou Storks (*Leptoptilus crumeniferus*) from Gambia, West Africa, presented by Dr. Percy Rendall; an English Wild Bull (*Bos taurus*, var.) from Chartley, Staffordshire, presented by the Earl Ferrers; a Ring-tailed Coati (*Nasua rufa* ♀) from Buenos Ayres, presented by Mr. C. W. Blacklock; two Tigers (*Felis tigris* ♂ ♀) from India, presented by H.R.H. the Duke of Clarence and Avondale; a Wedge-tailed Eagle (*Aquila audax*) from Australia, presented by Captain Salvin; an Alligator (*Alligator mississippiensis*) from the Mississippi, presented by Mr. Alexander Finlay; two Nightingales (*Daulias lusciniæ*), British, presented by Mr. J. Young, F.Z.S.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on July 3 = 16h. 47m. 29s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ' "
(1) G.C. 4373	—	Greenish-blue.	17 58 19	+66 37
(2) 337 Birm.	5 6	Reddish-yellow.	16 40 33	+8 47
(3) π Herculis	3	Yellow.	17 11 12	+36 56
(4) ε Herculis	3'4	Bluish-white.	16 56 6	+31 5
(5) 202 Schj.	8	Very red.	17 23 15	-19 24
(6) V Boötis	Var.	Reddish-yellow.	14 25 20	+39 21

Remarks.

(1) This is the planetary nebula famous in the history of astronomy as the first nebula which was examined by the spectroscope. The nebula, though small, is remarkably bright, and the lines in its spectrum are at least as bright as those in the nebula of Orion. The three principal lines in the green, and the hydrogen line at G, are seen without any difficulty.